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**METHOD AND APPARATUS FOR PARTITIONED ENVIRONMENT FOR WEB  
APPLICATION SERVERS**

**BACKGROUND OF THE INVENTION**

**1. Technical Field:**

5       The present invention relates generally to an  
improved data processing system, and in particular to a  
method and apparatus for managing applications on a  
server. Still more particularly, the present invention  
provides a method, apparatus, and computer implemented  
10 instructions for accessing applications on server using a  
universal resource locator.

**2. Description of Related Art:**

15       The Internet, also referred to as an "internetwork",  
is a set of computer networks, possibly dissimilar, joined  
together by means of gateways that handle data transfer  
and the conversion of messages from protocols of the  
sending network to the protocols used by the receiving  
network (with packets if necessary). When capitalized,  
the term "Internet" refers to the collection of networks  
20 and gateways that use the TCP/IP suite of protocols.

25       The Internet has become a cultural fixture as a  
source of both information and entertainment. Many  
businesses are creating Internet sites as an integral part  
of their marketing efforts, informing consumers of the  
products or services offered by the business or providing  
other information seeking to engender brand loyalty. Many  
federal, state, and local government agencies are also  
employing Internet sites for informational purposes,  
particularly agencies, which must interact with virtually

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all segments of society such as the Internal Revenue Service and secretaries of state. Providing informational guides and/or searchable databases of online public records may reduce operating costs. Further, the Internet  
5 is becoming increasingly popular as a medium for commercial transactions.

Currently, the most commonly employed method of transferring data over the Internet is to employ the World Wide Web environment, also called simply "the Web". Other  
10 Internet resources exist for transferring information, such as File Transfer Protocol (FTP) and Gopher, but have not achieved the popularity of the Web. In the Web environment, servers and clients effect data transaction using the Hypertext Transfer Protocol (HTTP), a known  
15 protocol for handling the transfer of various data files (e.g., text, still graphic images, audio, motion video, etc.). The information in various data files is formatted for presentation to a user by a standard page description language, the Hypertext Markup Language (HTML). In  
20 addition to basic presentation formatting, HTML allows developers to specify "links" to other Web resources identified by a Uniform Resource Locator (URL). A URL is a special syntax identifier defining a communications path to specific information. Each logical block of  
25 information accessible to a client, called a "page" or a "Web page", is identified by a URL. The URL provides a universal, consistent method for finding and accessing this information, not necessarily for the user, but mostly for the user's Web "browser". A browser is a program  
30 capable of submitting a request for information identified by an identifier, such as, for example, a URL. A user may enter a domain name through a graphical user interface

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(GUI) for the browser to access a source of content. The domain name is automatically converted to the Internet Protocol (IP) address by a domain name system (DNS), which is a service that translates the symbolic name entered by the user into an IP address by looking up the domain name in a database.

On the Web, the URL is the key to accessing everything on the Web, including Web sites, files, and applications. One wrong letter or a misplaced punctuation mark can make a difference between a usable and a useless URL for a Web site. For Web site developers one important item for considering during development of a Web site is an identification of the final URLs for that site. Failure to take this identification into consideration may result in frustrated users and unhappy customers.

In Web site development, several developers and analysts may simultaneously work on the actual development of a single Web site. It is important to development applications for the Web site as if they are actually being served up or accessed on the Internet. With the URL issue, the URL used by each developer working on the Web site must be the same if they are working with the same application. Web sites that make use of many different applications and development languages require different skills/expertise from a variety of developers. In order for those developers to use the same URL in their development, they must access the same files on the same host.

Therefore, it would be advantageous to have an improved method, apparatus, and computer instructions for managing development of applications.

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### SUMMARY OF THE INVENTION

The present invention provides a method, apparatus,  
and computer instructions for managing access to a set of  
applications associated with a universal resource locator  
5 in a data processing system. A request is received in  
which the request includes the universal resource locator  
and a user identification. The request is directed to a  
selected application within the set of applications using  
the universal resource locator and the user  
10 identification. In these examples, the set of  
applications is a set of instances of a single  
application.

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**BRIEF DESCRIPTION OF THE DRAWINGS**

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

**Figure 1** is a pictorial representation of a network of data processing systems in which the present invention may be implemented;

**Figure 2** is a block diagram of a data processing system that may be implemented as a server in accordance with a preferred embodiment of the present invention;

**Figure 3** is a block diagram illustrating a data processing system in which the present invention may be implemented;

**Figure 4** is a diagram illustrating components used in accessing applications in accordance with a preferred embodiment of the present invention;

**Figure 5** is a diagram illustrating examples of entries in accordance with a preferred embodiment of the present invention;

**Figure 6** is a flowchart of a process used for accessing a set of applications using the same universal resource locator (URL) in accordance with a preferred embodiment of the present invention;

**Figure 7** is a flowchart of a process used for preprocessing source code in accordance with a preferred embodiment of the present invention; and

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**Figure 8** is a flowchart of a process used for rewriting URLs for an application in accordance with a preferred embodiment of the present invention

FIG. 8

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

With reference now to the figures, **Figure 1** depicts a pictorial representation of a network of data processing systems in which the present invention may be implemented.

5 Network data processing system **100** is a network of computers in which the present invention may be implemented. Network data processing system **100** contains a network **102**, which is the medium used to provide communications links between various devices and computers  
10 connected together within network data processing system **100**. Network **102** may include connections, such as wire, wireless communication links, or fiber optic cables.

In the depicted example, a server **104** is connected to network **102** along with storage unit **106**. In addition,  
15 clients **108**, **110**, and **112** also are connected to network **102**. These clients **108**, **110**, and **112** may be, for example, personal computers or network computers. In the depicted example, server **104** provides data, such as boot files, operating system images, and applications to clients  
20 **108-112**. Clients **108**, **110**, and **112** are clients to server **104**. Network data processing system **100** may include additional servers, clients, and other devices not shown.

The present invention may be implemented within network data processing system **100** to allow for  
25 programmers or developers of applications to access a set of applications on a server, such as server **104** through clients, such as **108-112**. Specifically, this set of applications is accessed using a single URL. The particular application accessed or served by the server is  
30 based on an identification of the user. In these examples, the identification may be based on the IP

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address of the client or on a user name contained in a request from the client at which the user is located. This mechanism is particularly useful when each programmer or developer is accessing a copy of the application. In  
5 other words, the set of applications are instances of a single application. All of these instances are accessed through the same universal resource locator (URL). In this manner, testing of applications using URL may be made using the desired URL by multiple programmers or

10 developers accessing different instances of an application. These processes may be implemented within a proxy located at the server or some other locations, such as a gateway providing access to the server or the clients

In the depicted example, network data processing  
15 system **100** is the Internet with network **102** representing a worldwide collection of networks and gateways that use the TCP/IP suite of protocols to communicate with one another. At the heart of the Internet is a backbone of high-speed data communication lines between major nodes or host  
20 computers, consisting of thousands of commercial, government, educational and other computer systems that route data and messages. Of course, network data processing system **100** also may be implemented as a number of different types of networks, such as for example, an  
25 intranet, a local area network (LAN), or a wide area network (WAN). **Figure 1** is intended as an example, and not as an architectural limitation for the present invention.

Referring to **Figure 2**, a block diagram of a data processing system that may be implemented as a server,  
30 such as server **104** in **Figure 1**, is depicted in accordance with a preferred embodiment of the present invention. Data processing system **200** may be a symmetric



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multiprocessor (SMP) system including a plurality of processors **202** and **204** connected to system bus **206**. Alternatively, a single processor system may be employed. Also connected to system bus **206** is memory

5 controller/cache **208**, which provides an interface to local memory **209**. I/O bus bridge **210** is connected to system bus **206** and provides an interface to I/O bus **212**. Memory controller/cache **208** and I/O bus bridge **210** may be integrated as depicted.

10 Peripheral component interconnect (PCI) bus bridge **214** connected to I/O bus **212** provides an interface to PCI local bus **216**. A number of modems may be connected to PCI bus **216**. Typical PCI bus implementations will support four PCI expansion slots or add-in connectors.

15 Communications links to network computers **108-112** in **Figure 1** may be provided through modem **218** and network adapter **220** connected to PCI local bus **216** through add-in boards.

20 Additional PCI bus bridges **222** and **224** provide interfaces for additional PCI buses **226** and **228**, from which additional modems or network adapters may be supported. In this manner, data processing system **200** allows connections to multiple network computers. A memory-mapped graphics adapter **230** and hard disk **232** may  
25 also be connected to I/O bus **212** as depicted, either directly or indirectly.

Those of ordinary skill in the art will appreciate that the hardware depicted in **Figure 2** may vary. For example, other peripheral devices, such as optical disk  
30 drives and the like, also may be used in addition to or in place of the hardware depicted. The depicted example is

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not meant to imply architectural limitations with respect to the present invention.

The data processing system depicted in **Figure 2** may be, for example, an IBM RISC/System 6000 system, a product  
5 of International Business Machines Corporation in Armonk, New York, running the Advanced Interactive Executive (AIX) operating system.

With reference now to **Figure 3**, a block diagram illustrating a data processing system is depicted in which  
10 the present invention may be implemented. Data processing system **300** is an example of a client computer. Data processing system **300** employs a peripheral component interconnect (PCI) local bus architecture. Although the depicted example employs a PCI bus, other bus  
15 architectures such as Accelerated Graphics Port (AGP) and Industry Standard Architecture (ISA) may be used. Processor **302** and main memory **304** are connected to PCI local bus **306** through PCI bridge **308**. PCI bridge **308** also may include an integrated memory controller and cache  
20 memory for processor **302**. Additional connections to PCI local bus **306** may be made through direct component interconnection or through add-in boards. In the depicted example, local area network (LAN) adapter **310**, SCSI host bus adapter **312**, and expansion bus interface **314** are  
25 connected to PCI local bus **306** by direct component connection. In contrast, audio adapter **316**, graphics adapter **318**, and audio/video adapter **319** are connected to PCI local bus **306** by add-in boards inserted into expansion slots. Expansion bus interface **314** provides a connection  
30 for a keyboard and mouse adapter **320**, modem **322**, and additional memory **324**. Small computer system interface

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(SCSI) host bus adapter **312** provides a connection for hard disk drive **326**, tape drive **328**, and CD-ROM drive **330**.

Typical PCI local bus implementations will support three or four PCI expansion slots or add-in connectors.

5       An operating system runs on processor **302** and is used to coordinate and provide control of various components within data processing system **300** in **Figure 3**. The operating system may be a commercially available operating system, such as Windows 2000, which is available from  
10   Microsoft Corporation. An object oriented programming system such as Java may run in conjunction with the operating system and provide calls to the operating system from Java programs or applications executing on data processing system **300**. "Java" is a trademark of Sun  
15   Microsystems, Inc. Instructions for the operating system, the object-oriented operating system, and applications or programs are located on storage devices, such as hard disk drive **326**, and may be loaded into main memory **304** for execution by processor **302**.

20       Those of ordinary skill in the art will appreciate that the hardware in **Figure 3** may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile memory) or optical disk drives and the like, may be used  
25   in addition to or in place of the hardware depicted in **Figure 3**. Also, the processes of the present invention may be applied to a multiprocessor data processing system.

30       As another example, data processing system **300** may be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not data processing system **300** comprises some

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type of network communication interface. As a further example, data processing system **300** may be a Personal Digital Assistant (PDA) device, which is configured with ROM and/or flash ROM in order to provide nonvolatile memory for storing operating system files and/or user-generated data.

The depicted example in **Figure 3** and above-described examples are not meant to imply architectural limitations. For example, data processing system **300** also may be a notebook computer or hand held computer in addition to taking the form of a PDA. Data processing system **300** also may be a kiosk or a Web appliance.

With reference now to **Figure 4**, a diagram illustrating components used in accessing applications is depicted in accordance with a preferred embodiment of the present invention. In this example, server **400** provides access to clients **402** and **404**. Programmers or developers access applications **406**, **408**, and **410** on server **400**. Access to these applications is provided through proxy server **412** on server **400**.

The programmers or developers access these applications using the same URL in these examples. Proxy server **412** provides a mechanism for a partitioned development environment also referred to as a "sandbox". Proxy server **412** assigns a copy of the application for each user and dynamically modifies references to a particular instance or copy of the application based on which user is accessing this instance or copy. Proxy server **412** receives requests from clients and provides the appropriate redirection of the request to Web server **414** to provide access to application **406-410**.

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For example, applications **406-410** are instances or copies of a single application. A first user at client **402** may be assigned application **406**, while a second user at client **404** is assigned application **408**. Both the first and second users access their assigned applications using the same URL. In actuality each of these copies or instances of this application are located and accessed through a different URL. These assignments are stored within user database **416** in these examples. An identification of the URL for a particular copy or instance is placed in each entry. Proxy server **412** actually dynamically modifies the access or URL to the one assigned to each user. In other words, proxy server **412** provides an illusion that the user is the only one working on the application.

In this example, proxy server **412** includes a process to identify the user. This process may detect where or what location from which the user is generating a request. Alternatively, the user may access a different host as a starting point, which would then redirect the user to the correct location and to their application instance. With an identification of the user, proxy server **412** will redirect the user to the application assigned to the user, while being careful to keep the URL unchanged as shown in the browser and passed to the application. Proxy server **412** is used since Web server **414** can only interpret a URL in one way. Proxy server **412** functions to change the URL received from users at clients **402** and **404** depending on the identification of the user. This identification may be, for example, based on an IP address of the client or a user name contained within the request along with the URL identifying the

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application. This identification information located within the request may be compared to entries within user database **416** to identify the appropriate redirection.

At this point, we are ready to pass off the request to a file system or Web application server. Now, the application is modified on the fly to make the application think that it is running as the only application. To accomplish this result, the source code is preprocessed for the application either in batch or dynamically as the application is compiled or interpreted. This can include rewriting URLs as they are passed to and from the application or rewriting URLs in the source code just before compilation or building.

These processes are illustrated in more detail in **Figures 7 and 8** below. The server applications that are serving the application being developed also may be modified to contain many instances of the application with identical settings but different names. In this case, the proxy designates which named instance is to be activated.

Turning now to **Figure 5**, a diagram illustrating examples of entries is depicted in accordance with a preferred embodiment of the present invention. Entries **500**, **502**, and **504** are examples of entries, which may be located in user database **416** in **Figure 4**. The proxy server, such as proxy server **412** in **Figure 4**, may access these entries to redirect the request to the appropriate instance of an application for a user. The entries are indexed by identifications of the user. Each entry includes a user identification and a URL. This URL points to the application associated within or assigned to the user. Entries **500** and **502** identify a user based on a location, which are IP addresses for these entries.

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Entry **504** identifies a user based on a user name. Of course, other types of identifications may be used depending on the particular implementation. This example illustrates different types of user identifications with a single user database. All of the entries could be of the same type of identification rather than using different types of identifications as identified in **Figure 5**.

Turning next to **Figure 6**, a flowchart of a process used for accessing a set of applications using the same universal resource locator (URL) is depicted in accordance with a preferred embodiment of the present invention. The process illustrated in **Figure 6** may be implemented in a proxy server, such as proxy server **412** in **Figure 4**.

The process begins by receiving a request from a user (step **600**). This request is received from a client, such as client **402** or **404** in **Figure 4**. The request contains a URL for an application. Next, the user and URL are identified (step **602**). In these examples, the identification of the user may be based on an IP address or a user name contained within the request. The request is then redirected to a URL associated with the user based on the identification of the user (step **604**) with the process terminating thereafter. The request may be redirected by identifying another URL for the application assigned to the user. This URL is the URL actually used to make the request to a Web server, such as Web server **414** in **Figure 4**.

The proxy server may redirect URLs using two options. One involves preprocessing the source code before compilation and building to incorporate the URL

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while the other option involves dynamic rewriting of the URL passed back and forth to the application.

With reference next to **Figure 7**, a flowchart of a process used for preprocessing source code is depicted in accordance with a preferred embodiment of the present invention. The process illustrated in **Figure 7** may be implemented in a proxy server, such as proxy server 412 in **Figure 4**.

The process begins with starting compilation of the source code (step 700). As part of this process, the URLs are rewritten in source code (step 702). Compilation of the source code with the rewritten URLs then occurs (step 704). Next, the source code is restored to its original state for later use (step 706) and the process terminates thereafter.

Turning next to **Figure 8**, a flowchart of a process used for rewriting URLs for an application is depicted in accordance with a preferred embodiment of the present invention. The process illustrated in **Figure 8** may be implemented in a proxy server, such as proxy server 412 in **Figure 4**.

The process begins by receiving a request from a client, such as one at which a developer is located (step 800). The URLs in the request are mapped to the appropriate application (step 802). The application processes the request and sends a response (step 804). The applications response is mapped to the request URL (step 806). The response is sent back to the requestor (step 808) and the process terminates thereafter.

Thus, the present invention provides an improved method, apparatus, and computer instructions for



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accessing applications using the same URL. With the above described mechanism, multiple users may access multiple instances of the same application on the same environment, such as the same server or local area network. The mechanism of the present invention dynamically maps or changes the URL to one for the instance associated with or assigned to a particular user.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media, such as a floppy disk, a hard disk drive, a RAM, CD-ROMs, DVD-ROMs, and transmission-type media, such as digital and analog communications links, wired or wireless communications links using transmission forms, such as, for example, radio frequency and light wave transmissions. The computer readable media may take the form of coded formats that are decoded for actual use in a particular data processing system.

The description of the present invention has been presented for purposes of illustration and description, and is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in

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the art. The examples illustrated provide access to  
difference instances or copies of the same application.  
The mechanism of the present invention also may be  
applied to different applications using the same URL  
5 based on an identification of the user. The embodiment  
was chosen and described in order to best explain the  
principles of the invention, the practical application,  
and to enable others of ordinary skill in the art to  
understand the invention for various embodiments with  
10 various modifications as are suited to the particular use  
contemplated.

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